*At Greenwich on March* 17

Sun rises, 6h. 11m.; souths, 12h. 8m. 23·5s.; sets, 18h. 7m.: right asc. on meridian, 23h. 49·4m.; decl. 1° 9′ S. Sidereal Time at Sunset, 5h. 48m.

Moon (Full on March 17, 12h.) rises, 18h. 10m.; souths, 0h. 42m.*; sets, 6h. 58m.*: right asc. on meridian, 12h. 24·6m.; decl. 2° 39′ N.

| Planet. | Rises. h. m. | Souths. h. m. | Sets. h. m. | Right asc. and declination on meridian. h. m. | ° ′ |
|---|---|---|---|---|---|
| Mercury.. | 5 32 | 10 29 | 15 26 | 22 9·6 | 12 51 S. |
| Venus..... | 6 55 | 14 44 | 22 33 | 2 25·1 | 19 21 N. |
| Mars ...... | 6 53 | 13 38 | 20 33 | 1 19·3 | 8 8 N. |
| Jupiter.... | 2 50 | 6 46 | 10 42 | 18 26·2 | 23 0 S. |
| Saturn.... | 13 47 | 21 25 | 5 3* | 9 7·7 | 17 44 N. |
| Uranus ... | 20 14* | 1 39 | 7 4 | 13 18·3 | 7 34 S. |
| Neptune.. | 8 27 | 16 11 | 23 55 | 3 52·3 | 18 32 N. |

* Indicates that the rising is that of the preceding evening and the southing and setting those of the following morning.

| Mar. | h. | |
|---|---|---|
| 18 | 21 | Mercury at greatest distance from the Sun. |
| 20 | 10 | Sun in equator: day and night of equal length. |

*Variable Stars.*

| Star. | R.A. h. m. | Decl. ° ′ | | h. m. | |
|---|---|---|---|---|---|
| ζ Geminorum | 6 57·5 | 20 44 N. | Mar. 19, | 21 10 | *m* |
| R Canis Majoris | 7 14·5 | 16 11 S. | ,, 19, | 18 49 | *m* |
| | | | and at intervals of | 27 16 | |
| U Monocerotis | 7 25·5 | 9 33 S. | Mar. 19, | | *m* |
| V Cancri | 8 15·4 | 17 38 N. | ,, 23, | | *M* |
| S Cancri | 8 37·6 | 19 26 N. | ,, 21, | 6 16 | *m* |
| R Leonis | 9 41·6 | 11 57 N. | ,, 23, | | *M* |
| W Virginis | 13 20·3 | 2 48 S. | ,, 23, | 23 0 | *M* |
| U Coronæ | 15 13·7 | 32 3 N. | ,, 17, | 22 15 | *m* |
| β Lyræ | 18 46·0 | 33 14 N. | ,, 17, | 20 0 | *m* |
| | | | ,, 21, | 1 30 | $m_2$ |
| Y Cygni | 20 47·6 | 34 14 N. | ,, 17, | 18 0 | †*m* |
| | | | and at intervals of | 36 0 | |
| δ Cephei | 22 25·0 | 57 51 N. | Mar. 17, | 20 0 | *M* |
| | | | ,, 23, | 5 0 | *M* |

*M* signifies maximum; *m* minimum; $m_2$ secondary minimum.

† Y Cygni should be watched with especial care, as the time of minimum is subject to considerable uncertainty.

*Meteor-Showers.*

| | R.A. ° | Decl. ° | |
|---|---|---|---|
| Near θ Ursæ Majoris | 144 | 50 N. | March 20. |
| ,, β Ursæ Majoris | 162 | 57 N. | Slow. |
| ,, ι Herculis | 263 | 47 N. | |

## GEOGRAPHICAL NOTES.

THE paper on Monday night at the Royal Geographical Society was by the Hon. G. Curzon, M.P., and dealt with the Trans-Caspian Railway, over which Mr. Curzon recently travelled from the Caspian to Samarcand, a distance of 900 miles. Mr. Curzon described the structure of the railway, the engineering and other difficulties met with, the geographical features of the country traversed, and referred in some detail to the political, civilizing, and commercial results of the undertaking. The line is on a 5-foot gauge, which is uniform with the railway system of European Russia, but not with that of British India. The rails are of steel, from 19 to 22 feet long, and are laid upon wooden sleepers at the rate of 2000 sleepers to every mile, being simply spiked down without chairs or bolts. Every piece of timber, iron, and steel employed was brought from the forests or workshops of Russia, for the most part down the Volga and across the Caspian. The line is a single one from start to finish, except at the stations, where there are invariably sidings, and sometimes triangles, for an engine to reverse; it is laid upon a low earthwork or embankment thrown up with the soil scooped out of a shallow trench on either side. The permanent way is not metalled. It has been claimed that this railway is an astonishing engineering phenomenon, inasmuch as it traverses a country previously believed to be inaccessible to such a method of locomotion. But Mr. Curzon maintains, apart from the local lack of material due to the appalling dearth of the country, it is probably the easiest and simplest railway ever built. The region which it traverses is as flat as a billiard-table for almost the entire distance, the steepest gradient being 1 in 150. There are no tunnels, only a few insignificant cuttings, and but three bridges—across the Tejend, across the Murghab at Merv, and across the Amu-daria. The two main difficulties arose from scarcity of water and superabundance of sand. The former was not difficult to overcome, and the various means employed to check the destructive effects of sand will no doubt prove efficacious, though constant watchfulness along the whole line will be required. The really formidable sands are limited to three districts: (1) the first thirty miles from the Caspian; (2) the stretch between the Merv Oasis and the Oxus; and (3) the stretch between the Oxus and Bokhara. Here no vegetation is either visible or, with rare exceptions, possible; the sand, of the most brillant yellow hue, is piled in loose hillocks and mobile dunes, and is swept hither and thither by powerful winds. It has all the appearance of a sea of troubled waves, billow succeeding billow in melancholy succession, with the sand driving like spray from their summits, and great smooth-swept troughs lying between, on which the winds leave the imprint of their fingers in wavy indentations, just like an ebb tide on the sea-shore. Near the Caspian the permanent way was soaked with sea-water so as to give it consistency; in other parts it was covered with a sort of armour-plating of clay. Elsewhere, and in the more desolate regions, other plans were adopted. Light wooden palisades, 3 or 4 feet high, made of pine laths, were driven into the tops of the dunes and formed a barrier against which the winds might pile the sands with impunity. Nurseries for suitable desert plants were started in the Persian Mountains, and the product of these, tamarisk, wild oats, &c., were planted on the sand-hillocks contiguous to the line. Here, too, was planted that strange and interesting denizen of the wilderness the *Saxaoul* (*Haloxylon ammodendron*), which with a scanty and often ragged upper-growth, strikes its sturdy roots deep down into the sand, and somehow or other derives sustenance from that to which it gives stability and permanence. Fascines of the branches of this plant were also cut, laid at right angles to the rails along the edge of the earthwork or embankment, and covered over with a layer of sand. In spite of all these precautions, the sand must always constitute a serious danger to the line. In referring to Merv, and the miles and miles of ruins of the various old Mervs, Mr. Curzon gives the area of the oasis as 1600 square miles, with a population of not more than 100,000. The desert by which the oasis is surrounded is appalling. East and west, and north and south, stretches a troubled ocean of sand, each wave arrested, as it were, in mid career, when just curving to fall. Mr. Curzon never saw anything more melancholy than this wilderness with its sickle-shaped dome-like ridges of sand, succeeding each other with the regularity of infantry files. Each has the appearance of being cloven through the crown, the side facing towards the north-east, whence the prevailing winds blow, being uniform, convex, and smooth, while the southern face is vertical and abrupt. With regard to the famous bridge over the Oxus, Mr. Curzon states that its total length is 2000 yards, and that it rests on more than 3000 piles. The level of the rails is about 30 feet above low, but only 5 feet above high, water.

To the March number of the *Scottish Geographical Magazine*, an instructive paper on the Islands of Melanesia is contributed by Dr. R. H. Codrington. Mr. Ravenstein, in a paper accompanied by a map, on Lake Bangweolo, corrects the configuration of the lake based on a wrong interpretation of Livingstone's observations. Comparing them with subsequent results, Mr. Ravenstein shows that the length of the lake is north and south, and that the Luapula issues from its south-west corner. Mr. Ralph Richardson brings together a useful collection of data on the Edinburgh earthquake of January last.

THE Foreign Office has just published some extracts from a journal kept by Mr. W. J. Archer, British Vice-Consul at Chiengmai, or Zimmé, of a visit to Chiengtung, in May and June 1888. Mr. Archer traversed the little-known and mountainous region lying between the Rivers Salween and Cambodia, taking altogether thirty-six days for his journey both ways. From Chiengmai to Chienghai there are only a few towns, some of them inhabited by Luwas, the aborigines of the country. The hills, which abound in tigers, are uncultivated, but the valleys and low-lying grounds appeared well tilled, and bearing good crops of rice and paddy. North of Chienghai he saw the effects of attacks by the dacoits on the villagers. The former were Ngios from the Chiengtung territory, led by a Lao. Mr. Archer says that he was surprised to see what little traffic there was on the road, but this, perhaps, was due to some extent to

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the very heavy rains. The highest mountain-range of the whole region is a little south of Chiengtung, and is about 4400 feet high. After leaving Müang Hai, no signs of habitation were seen until Chiengtung was reached. As an instance of the insecurity of the country, he mentions that with one party he saw a young woman armed like the men. The plateau of Chiengtung is about 2700 feet above the sea-level, and is very bare and badly cultivated. The town itself is walled, and is situated in the southern corner of the plateau, which is inclosed by high mountains on the west, south, and east. The chief products are rice, cotton, and opium; tea is also cultivated on the hills. Cotton goods are imported from Moulmein; salt, silk, and other articles from Yünnan; cocoa-nuts and betel-nuts from Chienghai. The inhabitants of the district belong to several races; the majority are of the same people as the ruling family, but there are also numbers of Western Shans, of the hill tribes (the Kins, Kans, and Musös), and Lëms and Lüs. The houses of the people are as miserable as could be, and their great poverty is shown by the fact that, instead of their temples being made of brick, as is the case in Siam, they are wretched sheds, almost as miserable as the houses. Mr. Archer returned by a different road, and found whole districts uninhabited between Chiengtung and Muang Lën, which is close to the Cambodia River.

THE *Manchester Guardian* publishes some interesting information as to the movements of Dr. Lansdell. In October last he arrived at Khoten, whence he set out for Yarkand. He left Yarkand for Western Tibet and crossed the Kilian Pass at a height of 17,000 feet on December 2. On the 10th the Karakoram was passed without very much difficulty; but a few days later, when crossing the Saser, the party suffered very much from the intense cold. On November 14, Dr. Lansdell sighted at Changlung the first inhabited huts of the Tibetans. Crossing over Khardung Pass with great difficulty, he finally arrived at Leh, where he remained for a few days, setting out on December 5 to descend to Kashmir. To aid in this attempt, forty men were sent by the local authorities, and Zogiha Pass was crossed in safety, and Kashmir reached. In a few days Srinagur was reached, but Soultem Passes were blocked, and an attempt to penetrate them was abandoned. At Rawul Pindee, Dr. Lansdell's journey finished, he having travelled from Kuldja 2000 miles, crossing seven of the highest passes in the world.

THE Government Geologist who set out from Adelaide some months ago to explore Central Australia has just returned. He travelled as far north as Alice Springs—that is, to the Tropic of Capricorn—and spent nearly a fortnight there examining the ruby and gold fields. Between Anna Creek and Alice Springs the country is well watered, but at the diggings water is very scarce. In all, some 2400 miles were travelled, and, around the ruby fields, camels were employed. The heat was very great, on one occasion reaching as much as 124° F. in the shade.

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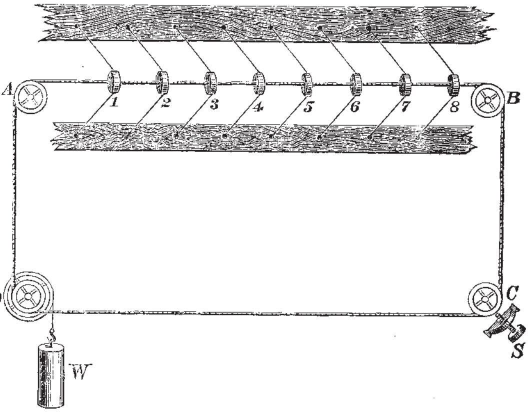
## *THE DISCHARGE OF A LEYDEN JAR.*[1]

IT is one of the great generalizations established by Faraday, that all electrical charge and discharge is essentially the charge and discharge of a Leyden jar. It is impossible to charge one body alone. Whenever a body is charged positively, some other body is *ipso facto* charged negatively, and the two equal opposite charges are connected by lines of induction. The charges are, in fact, simply the ends of these lines, and it is as impossible to have one charge without its correlative as it is to have one end of a piece of string without there being somewhere, hidden it may be, split up into strands it may be, but somewhere existent, the other end of that string.

This I suppose familiar fact that all charge is virtually that of a Leyden jar being premised, our subject for this evening is at once seen to be a very wide one, ranging in fact over the whole domain of electricity. For the charge of a Leyden jar includes virtually the domain of electrostatics; while the discharge of a jar, since it constitutes a current, covers the ground of current electricity all except that portion which deals with phenomena peculiar to steady currents. And since a current of electricity necessarily magnetizes the space around it, whether it flow in a straight or in a curved path, whether it flow through wire or burst through air, the territory of magnetism is likewise invaded; and inasmuch as a Leyden jar discharge is oscillatory, and we now know the vibratory motion called light to be really an oscillating electric current, the domain of optics is seriously encroached upon.

But though the subject I have chosen would permit this wide range, and though it is highly desirable to keep before our minds the wide-reaching import of the most simple-seeming fact in connection with such a subject, yet to-night I do not intend to avail myself of any such latitude, but to keep as closely and distinctly as possible to the Leyden jar in its homely and well-known form, as constructed out of a glass bottle, two sheets of tinfoil, and some stickphast.

The act of charging such a jar I have permitted myself now for some time to illustrate by the mechanical analogy of an inextensible endless cord able to circulate over pulleys, and threading in some portion of its length a row of tightly-gripping beads which are connected to fixed beams by elastic threads.



Mechanical analogy of a circuit partly *dielectric*; for instance, of a charged condenser. A is its positive coat, B its negative.

The cord is to represent electricity; the beads represent successive strata in the thickness of the glass of the jar, or, if you like, atoms of dielectric or insulating matter. Extra tension in the cord represents negative potential, while a less tension (the nearest analogue to pressure adapted to the circumstances) represents positive potential. Forces applied to move the cord, such as winches or weights, are electromotive forces; a clamp or fixed obstruction represents a rheostat or contact-breaker; and an excess or defect of cord between two strata of matter represents a positive or a negative charge.

The act of charging a jar is now quite easily depicted as shown in the diagram.

To discharge the jar one must remove the charging E.M.F. and unclamp the screw, *i.e.* close the circuit. The stress in the elastic threads will then rapidly drive the cord back, the inertia of the beads will cause it to overshoot the mark, and for an instant the jar will possess an inverse charge. Back again the cord swings, however, and a charge of same sign as at first, but of rather less magnitude, would be found in the jar if the operation were now suspended. If it be allowed to go on, the oscillations gradually subside, and in a short time everything is quiescent, and the jar is completely discharged.

All this occurs in the Leyden jar, and the whole series of oscillations, accompanied by periodic reversal and re-reversal of the charges of the jar, is all accomplished in the incredibly short space of time occupied by a spark.

Consider now what the rate of oscillation depends on. Manifestly on the elasticity of the threads and on the inertia of the matter which is moved. Take the simplest mechanical analogy, that of the vibration of a loaded spring, like the reeds in a musical box. The stiffer the spring, and the less the load, the faster it vibrates. Give a mathematician these data, and he will calculate for you the time the spring takes to execute one complete vibration, the "period" of its swing. [Loaded lath in vice.]

The electrical problem and the electrical solution are precisely the same. That which corresponds to the flexibility of the spring is in electrical language called static capacity, or, by Mr. Heaviside, permittance. That which corresponds to the inertia of ordinary matter is called electro-magnetic inertia, or self-induction, or, by Mr. Heaviside, inductance.

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[1] Friday evening discourse at the Royal Institution of Great Britain, on March 8, by Prof. Oliver J. Lodge, F.R.S.

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